We Claim:

1. A method of transmitting optical signals in an optical communication system, comprising:

receiving an optical input that has a first data rate;

splitting the optical input into a plurality of sub-wavelengths, wherein the plurality of sub-wavelengths are spaced sufficiently close in wavelength to provide a spectral efficiency of all the sub-wavelengths of the plurality of sub-wavelengths that is close to or greater than a spectral efficiency of the optical input;

combining the plurality of sub-wavelengths.

2. The method of claim 1, wherein a total bandwidth occupied by the sub-wavelengths is within a same ITU window of the optical input.

3. The method of claim 2, wherein the total bandwidth occupied by the sub-wavelengths is less than a bandwidth occupied by the optical input.

4. The method of claim 2, wherein the total bandwidth occupied by the sub-wavelengths is 5 times or less than a bandwidth occupied by the optical input.

5. The method of claim 1, wherein the optical input is serial and the plurality of the transmitted sub-wavelengths are parallel.

6. The method of claim 1, wherein the sub-wavelengths are generated by demultiplexing the optical input into the plurality of sub-wavelengths.

7. The method of claim 6, wherein the sub-wavelengths are demultiplexed using all-optical demultiplexing.

8. The method of claim 6, wherein the sub-wavelengths are demultiplexed by demultiplexing the optical input into a plurality of electronic signals that one or more optical transmitters.

9. The method of claim 1, wherein a plurality of optical transmitters are provided to produce the plurality of sub-wavelengths, each of an optical transmitter including a wavelength locker.

10. The method of claim 1, wherein a single optical transmitters is provided and uses subcarrier multiplexed modulation to produce the plurality of sub-wavelengths.

11. The method of claim 1, wherein a single optical transmitters is provided and uses optical single side band modulation to produce the plurality of sub-wavelengths.

12. The method of claim 7, wherein the plurality of sub-wavelengths from a plurality of optical transmitters are combined by a multiplexer or an optical coupler.

13. The method of claim 12, wherein a plurality of optical receivers are provided, each of an optical receiver of the plurality of optical receivers being configured to receive a sub-wavelength.

14. The method of claim 13, wherein each of optical receiver includes one of an optical wavelength demultiplexer, an optical splitter, or an optical add-drop multiplexer that separates the plurality of sub-wavelengths.

15. The method of claim 14, wherein the plurality of sub-wavelengths are introduced to multiple fixed optical to electrical converters.

16. The method of claim 13, wherein a number of sub-wavelengths is equal to a number of optical receivers.

17. The method of claim 16, wherein a number of sub-wavelengths is in the range of 4 to 32

18. The method of claim 1, wherein the first data rate is 10 Gb/sec or more.

19. The method of claim 1, wherein a sub-wavelength data rate of each subwavelength 50 Gb/s or less, and spacing of the sub-wavelengths is 25 GHz or less.

20. The method of claim 1, wherein a sub-wavelength data rate of each subwavelength is 10 Gb/s or less, and spacing of the sub-wavelengths is in the range of 5 to about 25 GHz.

21. The method of claim 1, wherein a sub-wavelength data rate of each subwavelength is 10 Gb/s or less, and spacing of the sub-wavelengths is in the range of to about 6 to 25 GHz.

22. The method of claim 1, wherein a sub-wavelength data rate of each subwavelength is 2.5 Gb/s or less, and spacing of the sub-wavelengths is in the range of to about 3 to 12.5 GHz.

23. The method of claim 1, wherein a number of subwavelengths is 2 and a sub-wavelength spaceing is in the range of 20 to about 100 GHz.

24. The method of claim 1, wherein a number of subwavelengths is 8 and a sub-wavelength spaceing is in the range of 5 to about 25 GHz.

25. The method of claim 1, wherein a number of subwavelengths is 4 and a sub-wavelength spaceing is in the range of 6 to about 25 GHz.

26. The method of claim 1, wherein a number of subwavelengths is 16 and a sub-wavelength spaceing is in the range of 3 to about 12.5 GHz.

27. The method of claim 1, wherein a number of subwavelengths is 4 and a sub-wavelength spaceing is in the range of 3 to about 12.5 GHz.

28. A method of transmitting optical signals in an optical communication system, comprising:

receiving an optical input that has a first spectral efficiency;

splitting the optical input into a plurality of sub-wavelengths, wherein the plurality of sub-wavelengths have a combined spectral efficiency close to or greater than that the first spectral efficiency; and

combining the plurality of sub-wavelengths.

29. The method of claim 28, wherein a sub-wavelength data rate of each subwavelength is 10 Gb/s or less, and spacing of the sub-wavelengths is in the range of 5 to about 25 GHz.

30. The method of claim 28, wherein a sub-wavelength data rate of each subwavelength is 10 Gb/s or less, and spacing of the sub-wavelengths is in the range of to about 6 to 25 GHz.

31. The method of claim 28, wherein a sub-wavelength data rate of each subwavelength is 2.5 Gb/s or less, and spacing of the sub-wavelengths is in the range of to about 3 to 12.5 GHz.

32. A method of transmitting optical signals in an optical communication system, comprising:

receiving an optical input that has a first data rate;

splitting the optical input into a plurality of sub-wavelengths, wherein each of a sub-wavelength of the plurality of sub-wavelengths is in a single ITU window; and

combining the plurality of sub-wavelengths.

33. A long haul optical communication system, comprising:

a first optical-to-electronic converter and a first electronic demultiplexer configured to receive and split an optical input into a plurality of sub-wavelengths, the optical input having a first data rate;

a plurality of optical transmitters coupled to the first electronic demultiplexer, wherein the plurality of optical transmitters are configured to transmit the plurality of sub-wavelengths with a wavelength spacing sufficiently close to provide a spectral efficiency of all the sub-wavelengths of the plurality of sub-wavelengths close to or greater than a spectral efficiency of the optical input;

a first optical multiplexer or first coupler;

a second optical demultiplexer, splitter or an OADM; and

a plurality of receivers coupled to the optical multiplexer or splitter and the first optical multiplexer or first coupler.

34. The system of claim 33 further comprising:

a second electronic multiplexer coupled to the plurality of receivers and configured to convert data rates of the plurality sub-wavelengths back to the first data rate.

35. The system of claim 33, wherein the first data rate is 10 Gb/sec or more.

36. The system of claim 33, wherein the plurality of receivers is wavelength-tunable.

37. The system of claim 33, wherein the plurality of receivers is not wavelength-tunable.

38. The system of claim 33, wherein a number of sub-wavelengths equals a number of receivers.

39. The system of claim 33, wherein a number of sub-wavelengths equals a number demultiplexed electronic signals.

40. The system of claim 33, wherein a total bandwidth occupied by the sub-wavelengths is within a same ITU window of the optical input.

41. The system of claim 40, wherein the total bandwidth occupied by the sub-wavelengths is less than a bandwidth occupied by the optical input.

42. The system of claim 40, wherein the total bandwidth occupied by the sub-wavelengths is about 5 times or less than a bandwidth occupied by the optical input.

43. A long haul optical communication system, comprising:

a first optical-to-electronic converter and a first electronic demultiplexer;

an optical transmitter with a common optical carrier coupled to the first electronic demultiplexer, the optical transmitter being configured to modulate the common optical carrier by using demultiplexed electronic signals and splitting an optical input with a first data rate into a plurality of sub-wavelengths, wherein sub-wavelengths of the plurality of sub-wavelengths each have a spectral efficiency close to or greater than a spectral efficiency of the optical input;

an optical demultiplexer or optical splitter;

a second electronic multiplexer; and

a plurality of receivers positioned to receive input from the optical demultiplexer or the optical splitter and produce an output that is coupled to the second electronic multiplexer.

44. The system of claim 43, wherein the first data rate is 10 Gb/sec or more.

45. The system of claim 43, wherein the plurality of receivers is wavelength-tunable.

46. The system of claim 43, wherein the plurality of receivers is not wavelength-tunable.

47. The system of claim 43, wherein a number of sub-wavelengths equals a number of receivers.

48. The system of claim 43, wherein a number of sub-wavelengths equals a number demultiplexed electronic signals.

49. The system of claim 43, wherein a total bandwidth occupied by the sub-wavelengths is within a same ITU window of the optical input.

50. The system of claim 49, wherein the total bandwidth occupied by the sub-wavelengths is less than a bandwidth occupied by the optical input.

51. The system of claim 49, wherein the total bandwidth occupied by the sub-wavelengths is about 5 times or less than a bandwidth occupied by the optical input